Packaging machine with a machine frame and method for the construction and alteration thereof

The invention relates to a packaging machine with a frame for receiving and fixing workstations, for example for forming, sealing, cutting and labelling packaging. In particular, the invention relates to a machine for the production of thermoformed packaging trays made of plastic film. In addition, the invention relates to methods for the construction and alteration of the said packaging machine.

Machines of the type in question comprise many workstations that fulfil various functions and are usually installed and aligned in series. After unwinding, and in some circumstances, heating, a plastic film passes through the stages of forming, cooling, filling, sealing, labelling and cutting. Here, it is above all important to ensure that the relative position of the individual workstations is permanently guaranteed, both in relation to each other and to the equipment operating over the entire length of the machine, such as, for example, the conveying device for the film web or webs.

The workstations must, therefore, be arranged in such a way that the alignment of the individual components in relation to each other is permanently ensured. One possibility for ensuring this is to use a machine frame encompassing the workstation in question. In the case of the known packaging machines with frames, prefabricated units comprising a frame and the actual workstation are arranged in sequence, aligned and optionally interconnected. In the packaging machines known from prior art, individual workstations can only be replaced with difficulty. In addition, in the majority of cases, the subsequent installation of new workstations with different dimensions in the known packaging machines is only possible at considerable expense.

It was, therefore, an object of the invention to provide a packaging machine that does not have the drawbacks of the prior art and is simple to produce and alter.

The object of the invention is achieved by a packaging machine with the features disclosed in claim 1. Preferred embodiments of the invention may be found in the dependent claims.

According to the invention, therefore, a packaging machine is provided that may be assembled using a simple method of construction and, if required, may also be extended or reduced by individual or several workstations. For this, the machine frame is constructed in a

way adapted to the machine dimensions in order to encompass the individual workstations in the machine. The machine frame substantially comprises transverse elements, which, with many longitudinal elements, on which the workstations are mounted in an at least partially displaceable way and attached fixably thereto.

Hereby, the longitudinal elements may have any cross section that is preferably constant along the length in order to facilitate the displacement of the fixing means in the longitudinal direction. This can, for example, be ensured if longitudinal elements with rectangular or square cross sections or even with profiled sheets are used. Particularly advantageous, however, is the use of tubes, preferably with a substantially, round cross-sectional area. This in particular opens up the possibility of connecting tubes together in a particularly simple way and of achieving a high degree of rigidity for the machine frame. Also preferred are profiles, preferably tubes with a rectangular or square cross section. The use of profiles of this kind greatly simplifies the displacement of the fixing means. In addition, the use of round tubes facilitates the cleaning of the machine, which, particularly when it is used as a packaging machine for foodstuffs, is performed frequently and thoroughly, since in this case, the cleaning agents can generally drain off and do not accumulate on the surfaces.

The length of the longitudinal elements is determined by the individual circumstances. The longitudinal elements may each extend over the entire length of the packaging machine or may also be shorter. The longitudinal elements may be made of one piece or each comprise several sections.

If the longitudinal elements comprise several sections, these are preferably connected in a way that ensures that the machine frame has a high degree of rigidity. A connection of this kind is provided in an advantageous embodiment of the invention if vertical straps are connected to the ends of the longitudinal elements. Placing the straps next to each other and connecting them in a reversible manner produces a particularly simple and secure positive and non-positive connection of the longitudinal elements, which can, moreover, be easily disconnected. In a particularly preferred embodiment of the invention, this connection of the straps is achieved by bolts. This particularly advantageous embodiment creates a connection of the longitudinal elements that is particularly easy to disconnect, adaptable to the circumstances in question and reliable.

In a further advantageous embodiment of the invention, the longitudinal elements are connected by means of a connecting element with two opposing threads, preferably a multi-edge connecting element. The connection of the longitudinal elements with the connecting

element achieves a firm connection. In addition, the connected longitudinal elements could also be pre-stressed. High rigidity of the machine frame is also ensured in this preferred embodiment of the invention.

Further preferred embodiments of the connection of the longitudinal elements are shown in Figures 9a, b and 10a, b.

In a further advantageous embodiment of the invention, pairs of vertically spaced longitudinal elements have connecting rods. These rods are able significantly to increase the rigidity of the frame structure. Here, it is particularly advantageous to attach the rods in a way that ensures that the displacement of the fixing means and/or workstations along the longitudinal elements is not impaired or at least remains possible. In a further particularly advantageous embodiment of the invention, these rods may be welded onto the longitudinal elements. On the one hand, this provides a type of connection that is simple to achieve between the longitudinal elements and on the other, it is also possible to attach the rods subsequently to the existing frame structure in order, for example, to increase the rigidity of the entire structure or even to reinforce only selected sections of the frame.

The fixing means may be attached to the packaging machine according to the invention in any shape and number. In order to ensure a reliable connection between the machine frame and the individual workstations in the packaging machine, it is advantageous if the fixing means at least partially enclose the longitudinal elements in a positive way. The fixing means may be in one piece and pushed onto the longitudinal elements before the assembly of the machine frame. Particularly advantageous is an embodiment of the fixing means in several parts, which, connected to each other, achieve the at least partial positive connection with the longitudinal elements. This will enable the subsequent attachment of further fixing means or the removal of superfluous fixing means even without at least partial dismantling of the machine frame.

In a particularly advantageous embodiment of the invention, the fixing means comprise two substantially identical halves connected together, which interact to enclose the longitudinal elements on two sides at least partially positively.

In principle, it is sufficient to mount the fixing means on one longitudinal element in each case. However, if round tubes are used as the longitudinal elements, to ensure the reliable and torsion-resistant mounting of the fixing means they must interact with at least two vertically spaced longitudinal elements, preferably round tubes. This embodiment of the

packaging machine according to the invention ensures the reliable fixing of the workstations on the longitudinal elements on the frame.

For the reliable fixing of the workstations in question on the frame, at least two fixing means are provided in each case, which are connected to two diagonally opposite application points on the workstation. Preferably, however, the workstations in question are fixed by means of at least three, preferably four, fixing means, whereby at least one fixing means must act on each longitudinal side of the workstation in question.

Also preferably, fixing means of any type are provided directly on the workstations. These workstations may be pushed inside the machine frame and then fixed to the desired location. The fixing is preferably achieved by friction locking with the longitudinal elements.

A transverse element for the purposes of the invention is any component which is suitable to function as a spacer between the longitudinal elements transverse to the longitudinal axis of the longitudinal elements and to ensure sufficient rigidity of the frame structure. A person skilled in the art will recognise that the transverse elements do not necessarily have to be produced from a solid material. It is also conceivable to provide frames, optionally reinforced by transverse or diagonal elements, grids, or even punched sheets such as perforated sheets or similar. A person skilled in the art will also recognise that the transverse elements could also be made up of several parts, for example, posts and cross struts of any shape.

Two transverse elements form the end walls of a packaging machine according to the invention. In addition, further transverse elements are used as required inside the frame. The installation of additional transverse elements in the frame significantly reinforces the construction. Reinforcing elements may also be installed subsequently at no significant cost if, for example, weak points are identified in individual areas of the construction. However, it may also be necessary to incorporate transverse elements temporarily, for example, if the loading on the frame structure is increased, perhaps during the transportation of the entire frame together with the workstations fixed therein. The transverse elements may also, for example during an alteration, be displaced along the longitudinal elements and then refixed.

In an advantageous embodiment of the invention, recesses are provided in the sides of the transverse elements that are suitable for receiving at least a partial circumference of the longitudinal elements. This kind of embodiment of the packaging machine according to the invention achieves a space-saving design of the machine frame in a particularly simple way.

Preferably, the packaging machine according to the invention has bracing elements at least in part sections. These bracing elements are preferably further longitudinal elements that extend over at least two transverse elements. This embodiment of the frame is a particularly efficient way of increasing the rigidity of the construction either selectively in part sections or in the entire frame.

In an advantageous embodiment of the invention, means for the displaceable mounting of the workstations are provided on the individual workstations to enable the position of the workstations to be changed, preferably along the longitudinal elements. This facilitates the displacement and, in particular, the adjustment of workstations in a way that is particularly simple and quick to perform.

In a particularly advantageous embodiment of the invention, these means are connected to the workstations. In an embodiment of the invention preferred above all, the displacement of the workstations in the machine frame is achieved by means of a toothed rack or spindle. This particularly preferred embodiment of the invention opens up a particularly reliable and infinitely variable possibility for adjustment, which also offers a high degree of accuracy.

It may also be useful to fix only some of the workstations inside the machine frame. This is always of advantage if exact alignment with the other workstations does not appear necessary. An embodiment of this kind is also an effective way of preventing the transmission of vibrations from one workstation to the other or to the entire frame.

In addition, means for securing cover plates or screens are preferably provided on the machine frame of the machine according to the invention. Individual machine areas in the frame are regularly covered to comply with the safety regulations applicable to the operation of a packaging machine of this type. The covers, may, for example, prevent the machine components from coming into contact with the operating personnel, thus preventing the contamination of the packaging films and minimising the risk of injury.

The frame of the packaging machine according to the invention is preferably produced from a material that has the strength and bearing capacity required to meet the aforementioned objectives and is also resistant to aggressive media such as detergents or disinfectants. Due to the high hygienic standards to be adhered to, regular thorough and extensive cleaning and disinfection of the entire system at short intervals is required, particularly when the machines are used for the production of packaging for foodstuffs. Therefore, it is useful to make the frame out of a material that is able to meet both objectives, such as, for example

aluminium or stainless steel. However, also conceivable is the fulfilment of both objectives by means of different components in a combination of materials, for example a coated material.

However, in view of the frequency of cleaning, the shape of the machine frame should always be designed with a view to ensuring that there are no areas that are difficult to access and in particular that there are no undrainable retaining areas in which residual amounts of detergent could accumulate.

The invention also relates to a method for the construction and alteration of the packaging machine according to the invention, which is described in more detail below. However, the stages of the method described should not be understood to be an exhaustive list of all the operations nor does the claimed list specify the sequence in which these operations should be performed when implementing the method according to the invention.

The method according to the invention for the construction of a packaging machine envisages that the construction and assembly of the machine frame will take the form of the connection of the longitudinal elements to the transverse elements. In this machine frame, the individual workstations are then suspended and then the relevant workstations are aligned by displacement and finally connected non-positively to the machine frame.

When performing the method according to the invention, a frame adapted to the machine to be constructed is produced with particularly simple means. In addition, this opens up the possibility of performing the construction quickly and with simple means on site.

In another method according to the invention, the packaging machine is altered, for example, in the event of defects in individual parts of the system, by removing the workstations from the existing frame after disconnecting the fixing means. A replacement station may then be placed in the frame and connected non-positively to the frame. This kind of embodiment of the method according to the invention enables system parts to be replaced in a particularly simple way and in a particularly short time, whereby the replacement station does not have to have the same longitudinal dimensions as the original station.

System parts with different dimensions from the parts they are replacing may be placed in the frame by displacing the other workstations along the longitudinal elements before or after the insertion of the new workstation. Similarly, for example if operational steps are abolished, a workstation may be removed and not replaced. The machine is then returned to the

optimum operating mode in a particularly simple way by means of the displacement of the remaining workstations in the existing machine frame.

The invention is described in more detail below with reference to **Figures 1-11**. The diagrams, however, only represent examples of a device according to the invention and do not restrict the general inventive idea in any way.

Figure 1 shows a partially simplified schematic representation of a packaging machine for the production of packaging.

Figure 2 shows an overview of a machine frame of a packaging machine according to the invention in a first embodiment.

Figure 3 shows an overview of a machine frame of a packaging machine according to the invention in a second embodiment.

Figure 4 shows an overview of a machine frame of a packaging machine according to the invention in a third embodiment.

Figure 5 shows an overview of a machine frame of a packaging machine according to the invention in a fourth embodiment.

Figure 6 shows a perspective magnified detail drawing of part of the fourth embodiment according to Figure 5.

Figure 7 shows a front view of the transverse element of the fourth embodiment according to Figure 5.

Figure 8a shows a perspective view of a further transverse element

Figure 8b shows a side view of the transverse element according to Figure 8a

Figures 9a, b show an embodiment of the connection between two longitudinal elements.

Figures 10a, b show a further embodiment of the connection between two longitudinal elements.

Figure 11 shows the mounting of a workstation on the machine frame

Figure 1 is a schematic drawing of the packaging machine according to the invention. A film 42 is rolled off a roller and first passes through a thermoforming station 43 comprising an upper tool 44 and a lower tool 45. The lower tool 45 is mounted on a plate 46, which, as indicated by the arrow, may be raised and lowered. The film 42 is formed into a packaging tray 47 in the thermoforming station 43.

Then, the packaging trays 47 are filled with packaged goods and the packaging trays sealed with a covering film in the downstream sealing station 48. The sealing station 48 also comprises an upper tool 49 and a lower tool 50 with it again being possible to raise and lower the lower tool in the sealing station.

Finally, the packaging is cut apart in the cutting station 51. The cutting station also comprises an upper tool 52 and a lower tool 53 with it again being possible to raise and lower the lower tool 53 in the cutting station.

Figure 2 shows a machine frame 1 comprising tubular longitudinal elements 2 and transverse elements 3. It also shows fixing elements 4 comprising an external half 5 and an internal half 6 attached to the longitudinal elements 2 is a displaceable and fixable way. Also attached are means 26 for fixing the transverse elements 3 to the longitudinal elements 2. The transverse elements 3 comprise on their undersides 11 recesses 7 for receiving a partial circumference of the longitudinal elements 2. Recesses 27 with the same shape are also provided in side walls of the transverse elements 3. The recesses 7 are designed so that, together with the means 26 for the fixing of the transverse elements 3, they enclose the longitudinal elements 2 in a positive way. The external halves 5 of the fixing means 4, 14 and the means 26 for the fixing of the transverse elements 3 may also have the same design. In this case, the recesses 7, 27 on the transverse elements 3 have a shape that forms a positive and/or non-positive connection between the transverse element 3 and the longitudinal element 2 when the transverse elements and the means 26 are joined together.

The entire machine frame 1 rests on many adjustable feet 9, with which level compensation is possible, for example in the case of an uneven floor.

The suspension of the workstations in the machine frame 1 requires at least two horizontally spaced and longitudinal elements 2 extending in parallel that connect the adjacent transverse elements 3 with each other. In addition, the rigidity of the construction may be

increased by the addition of an optional number of further longitudinal elements 2 to the existing longitudinal elements. For this, two longitudinal elements 12, 13 are attached in the central area 10 of the machine frame 1 for example on the underside 11 of the side walls of the wall elements 3.

Figure 3 also shows a machine frame 1 in which two longitudinal elements 15, 16, attached one on top of the other and extending in parallel, are connected to each other by means of many rods 17. In the diagram, these rods 17 are distributed evenly along the length of the machine frame 1. It is, however, also conceivable that the rods 17 could have a shorter spacing between them in certain areas and possibly even to be completely absent in other areas of the machine frame 1.

Figure 4 shows a machine frame 1 in a further embodiment. The longitudinal elements 25 in this embodiment comprise profile sheets 18 and rail-shaped elements 19 resting on blocks 20 kept at a distance from each other by a spacer 21 on the transverse elements 22. The recesses 23 in the transverse elements 22 have the same shape as the profile sheets 18. The profile sheets 18 are secured to the transverse elements 22 by slinging means 24. Means not shown here for fixing the machine components that are not shown here are mounted displaceably between the different slinging means 24. In the embodiment of the longitudinal elements 25 shown in Fig 3 and in every other type of embodiment in which the longitudinal elements 25 do not have a round cross section, it is sufficient for the reliable fixing of the workstations if the fixing means (not shown here) only interact with one longitudinal element 25 and are mounted thereon displaceably and fixably.

Figure 5 shows a machine frame 1 in which the transverse elements 3 comprise vertical transverse posts 28, transverse tubes 29 and lower and upper connecting means 30, 31 for the non-positive connection of the transverse posts 28 and transverse tubes 29. The means 28 and 29 are transverse elements within the meaning of the invention. At the ends of the superior pairs of longitudinal elements 15, 16 are the vertical straps 32 connecting the longitudinal elements 15 and 16 with each other. Several pairs of longitudinal elements 15, 16 are then connected by a positive and non-positive connection of the straps 32 for each pair of longitudinal elements 15, 16. The longitudinal elements 33 lying below the pairs of longitudinal elements 15, 16 are also connected to each other by means of straps 34 that are vertical to the longitudinal elements 33. The transverse posts 28 contain receptacles for the transverse tubes 29. In addition, the connecting means 30, 31 contain receptacles for the transverse posts 28 and the transverse tubes 29. In addition, the connecting means 30, 31 have apertures through which the longitudinal elements 15, 16, 33 may be led. In addition,

the upper connecting means 31 connect holding means 35 to which further means (not shown) may be secured to reinforce the transverse elements 3.

Figure 6 is a magnified detail drawing of the embodiment according to Figure 4. The straps 32, 34 have holes 36 to receive rivets or bolts for the non-positive connection of the straps 32, 34 connected to the longitudinal elements 15, 16, 33. The lower connecting means 30 comprise an external part 37 and an internal part 38. The internal part 38 of the lower connecting means 30 has a receptacle for a transverse tube 29 and a recess in which a partial circumference of the longitudinal element 33 is received. The internal part 38 connects the transverse post 28 positively. The external part 37 of the lower connecting means 30 also has a receptacle for a partial circumference of the longitudinal element 33. The parts 37 and 38 combined form a positive connection with the longitudinal element 33. The upper connecting means 31 comprise an external part 39 and an internal part 40. The external part 39 has two recesses to receive a partial circumference of the longitudinal elements 15 and 16. The internal part 40 also has these recesses so that combined the parts 39, 40 encircle the longitudinal elements 15, 16 positively. In addition, the internal part 40 connects holding means 41 extending in the longitudinal direction of the machine frame 1 in the form of two parallel, spaced clamping rails to receive further reinforcing elements (not shown) of the transverse elements 3.

Figure 7 is a section offset from the mirror axis through the transverse element 3 according to Figures 4 and 5. The internal parts 38 of the lower connecting means 30 connect feet 9 on which the entire machine frame rests. The internal parts 40 of the upper connecting means 31 are connected to holding means 35 in which there are grooves 41 in which further reinforcing elements may be inserted and/or locked.

Figure 8a is a perspective view of a further transverse element. In this case, the transverse posts 28 are designed as U-profiles in which are incorporated the internal parts 38, 40 of the connecting means. The longitudinal elements 2 are partially received by these connecting means. The external connecting means 37, 39 are screwed to the transverse posts and also partially enclose the longitudinal elements 2. The two transverse posts 28 are connected to each other by a sheet 61 that has been bent at the edges.

Figure 8b is a side view of the transverse element according to Figure 8a. This view clarifies in particular that all parts are connected to each other or designed so that gaps 63 are present through which cleaning water is able to drain out. This construction is very hygienic

since it prevents the accumulation of liquid. The distance between the sheet 61 and the transverse posts 28 is achieved by means of a washer 62, for example.

Figures 9a, b show an embodiment of the connection between two longitudinal elements 2 substantially comprising two L-shaped parts 2' and 2". The parts 2' and 2" are both welded to a longitudinal element. They are connected to each other by means of the thread 65 and bolts, not shown, centred in relation to each other by the pins 64.

Figures 10a, b show a further embodiment of the connection between two longitudinal elements 2 substantially designed as a peg 2" that is inserted in a hole 2'. The non-positive connection is provided by the pins 64 which are inserted into the relevant holes after the insertion of the peg into the hole

Figure 11 shows the mounting of a workstation on the machine frame. Each workstation has at least 2, preferably 4, wheels 66 running between the longitudinal elements 2 so that the workstations may be displaced along the machine frame. When they reach the desired position, the workstations are locked with the machine frame.

List of reference numbers

1	Machine frame
2	Longitudinal element
2'	Connecting element for the longitudinal elements
2	Connecting element for the longitudinal elements
3	Transverse element
4	Fixing means
5	External half of the fixing element
6	Internal half of the fixing element
7	Recesses in the undersides of the transverse elements
8	External side of the recesses
9	Feet of the machine frame
10	Central area of the machine frame
11	Underside of the transverse element
12	Longitudinal element
13	Longitudinal element
14	Fixing means
15	Longitudinal element
16	Longitudinal element
17	Rods
18	Profiled longitudinal element
19	Rail-shaped longitudinal element
20	Blocks
21	Spacer
22	Transverse element
23	Recess
24	Slinging means
25	Longitudinal element
26	Means for fixing the transverse elements
27	Recesses in the side walls of the transverse elements
28	Transverse posts
29	Transverse tubes
30	Lower connecting means
31	Upper connecting means
32	Strap
33	Lower longitudinal element
34	Strap

35 Holding means
36 Hole in the strap
37 External part of the lower connecting means
38 Internal part of the lower connecting means
39 External part of the upper connecting means
40 Internal part of the upper connecting means
41 Film
42 Upper path
43 Thermoforming station
44 Upper tool
45 Lower tool
46 Plate
47 Packaging tray
48 Sealing station
49 Upper tool
50 Lower tool
51 Cutting station
52 Upper tool
53 Lower tool
61 Bent sheet
62 Washer
63 Gap
64 Pins
65 Thread
66 Wheels

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